

Systematic Innovation Using TRIZ

INTRODUCTION

TRIZ: A Tool for Creativity and Innovation

The Soviet initiated Theory of Inventive Problem Solving, TRIZ, is a series of tools, methods and strategies developed by over 1500 person-years of research, and the study of over two million of the world's most successful patents. By distilling the essence of this work the method provides access to the knowledge and experiences of the world's finest inventive minds. It is intended to complement and add structure to our natural creativity rather than to replace it. The key findings of TRIZ research are that:

1. All innovations emerge from a small number of inventive principles and strategies
2. Technology evolution trends are highly predictable
3. The strongest solutions transform the unwanted or harmful elements of a system into useful resources
4. The strongest solutions also actively seek out and destroy the conflicts and trade-offs most design practices assume to be fundamental

At its very highest level, TRIZ may be seen as the systematic study of excellence. The study was initially focused on patents, and then evolved to look at excellence in the sciences, and latterly the arts, business, social sciences and politics. TRIZ can be used to boost creativity and systematic innovation on a number of levels: it provides an underlying philosophy, a method and a toolbox for creative solutions. Systematic Innovation is a complete problem-solving and creativity framework utilising the best aspects of TRIZ [2].

Inventive Principles and Trends of Evolution

An important aspect of TRIZ rests upon the basis that across all fields and throughout history, "someone, somewhere has already solved a problem like yours". Through the analysis of millions of successful patents TRIZ has created a generic problem-solving tool that encapsulates the knowledge, strategies and best practices of some of the most creative and innovative thinkers of our time. This research discovered that the best patents resolved a trade-off or contradiction, by minimising the effect of one factor relative to another. It was also found that the most creative or revolutionary solutions actively targeted or removed this trade-off with the use of a number of standard strategies or principles.

Through the course of the patent analysis and research it became apparent that, irrespective of the patents' field (i.e. aero-space, agriculture...), there were a finite number of contradictions being solved and inventive principles [1]

used to solve them. This then led to the creation of a generic problem solving tool or 'Contradiction Matrix', which allows instant access to the strategies and principles used within these highly successful designs. This matrix therefore aids the creation of highly creative solutions using the techniques adapted over the course of patent/human inventive history.

For example, an airplane must be both strong and lightweight; we begin by realizing that we are not the first person in the world that has had to solve this contradiction of Strength versus Weight. Mapping this specific problem to a generic problem using the contradiction matrix developed, allows access to the inventive strategies most commonly used in that type of problem. These principles can then be used to generate specific solutions, as demonstrated by Figure 1.

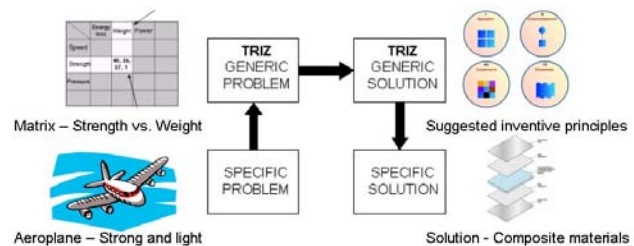


Figure 1: Specific - Generic problem mapping process

A further implication of this study was the 'trends of evolution'. As patents have to detail the patent they build-upon, it is possible to identify how a design has evolved over time. These trends, identified by TRIZ and further enhanced by CREAX researchers, can serve as both a prediction and problem-solving tool. They have been found powerful when applied to technology, processes, products and services, as shown in Figures 4 and 8.

SYSTEMATIC INNOVATION SOFTWARE: A CATALYST FOR CREATIVITY

A number of these TRIZ tools are extremely well suited to software applications. In addition to a large number of problem definition tools, the CREAX Innovation Suite software and others include tools that, whilst not replacing individual creativity, serve as a highly effective catalyst for human creativity during the problem solving and brainstorming process.

The contradiction matrix is included within the software allowing it to automatically suggest the **inventive principles** most relevant to the problem, Figure 2. Animations and examples then provide stimulus to catalyze the users' brainstorm from these appropriate starting points.



Figure 2: A selection of the 40 inventive principles

The use of these principles has been found to immeasurably increase the flow of ideas and the likelihood of finding a ‘wow’ solution, often making it possible to completely resolve the assumed trade-off.

The **trends of evolution** have also been encapsulated in the software. These trends can help provide the next inventive step. The user must first evaluate their system on the trend and how it applies to their problem/industry. Trend jumps can then be made using their creativity to generate new solutions.

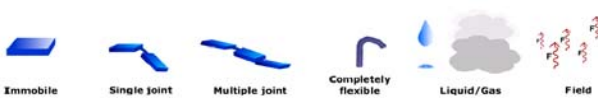


Figure 3: Trend of increasing dynamisation



Figure 4: One household example of the dynamisation trend, note how the function stayed constant whilst the method has changed.

The software also allows the generation of radar plots, Figure, that permit visualization of the **evolutionary potential** of a system, Figure 5. These help show development opportunities with potential for creative solutions. They can also be used to compare similar products to benchmark competition.

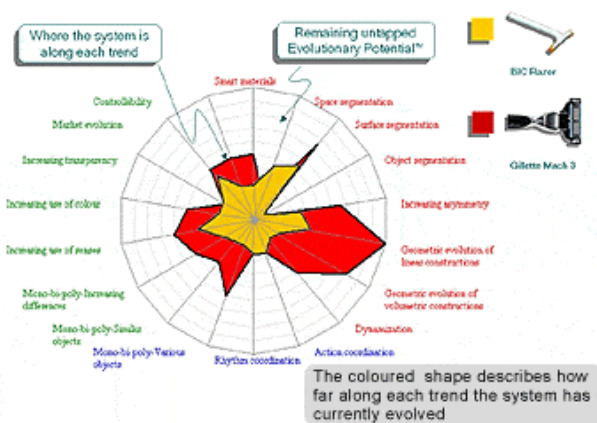


Figure 5: Radar plot comparing the evolutionary development of 2 similar products.

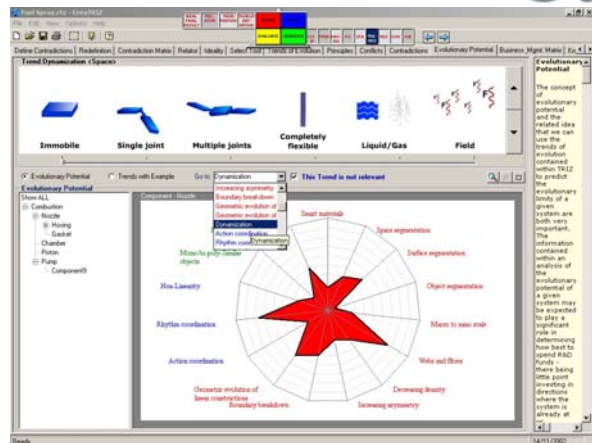


Figure 6: Screen shot of the Evolutionary plot function of the software. To find out more and conduct a free trial please go to <http://www.creax.com/tools/software.html>

Functional database

The trends also reveal a further key finding: during the evolutionary process: the *function stays constant yet the method* used to achieve that function may change. To aid this process a free **Functional Database** has been created, Figure 7, allowing users to search by function and explain a huge variety of functions. This allows users to rapidly acquire useful knowledge and ideas from unfamiliar fields.

‘Functions stay the same method changes’

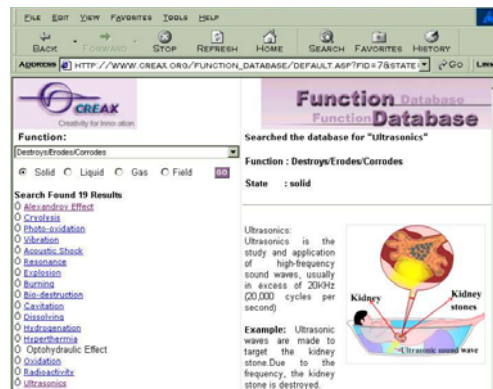


Figure 7: Free Function Database which allows users to view all different methods to perform a desired function, such as move liquid. function.creax.com

For example, the function of ‘moving water’ can be achieved in no less than 35 different ways many of which would be completely unknown to those outside of the specific fields. With this knowledge however, one method may spark the creation of a revolutionary discovery or solution that may never have been revealed without the aid of such software.

SYSTEMATIC INNOVATION DEVELOPMENT

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The method is being continually developed and refined, with over 5000 patents/month being analyzed at CREAX. Despite this increase in information no further principles have yet been uncovered, however the CREAX researchers have identified a number of new trends.



TRIZ and the Systematic Innovation philosophy are also being continually developed across new fields and



industries including business, the arts and food. So far the results have been found to be highly applicable across all domains.

REFERENCES

1. Mann D., *Hands-on Systematic Innovation*, CREAX Press, Belgium, 2002.
2. CREAX Innovation Suite, available at <http://www.creax.com/>, CREAX, 200